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ABSTRACT

In two separate studies involving 98 and 59 moderately mentally retarded children (mean ages 12 and 11 years), factor analyses of the Revised Illinois Test of Psycholinguistic Abilities (ITPA) were performed to determine if the subtests corresponded to the theoretical model of communication channels, processes, and levels. In the first study, raw scores from the 10 ITPA subtests together with Benet IQ scores were analyzed; in the second study, the 10 ITPA subtests plus the Wechsler Intelligence Scale for Children (Verbal and Performance IQ's), the Los Angeles Test of Perceptual-Motor Attributes and the Draw-A-Person Test were factor analyzed. Without loss of generality, both studies supported the channel separation in the theoretical model. (Author/CL)

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Further Analysis of the Structure of the Revised Illinois Test of Psycholinguistic Abilities for Moderately Mentally Retarded Children

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Running Head: Structure of ITPA

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Abstract

In two separate studies involving 98 and 59 moderately mentally retarded children respectively factor analyses of the Revised ITPA were carried out to determine if the subtests fit the theoretical model of channels, processes and levels of communication. In the first study raw scores from the 10 ITPA subtests together with Binet IQ were analyzed by the alpha factor analysis, image analysis and principal component analysis together with factor matching for more meaningful results. In the second study the 10 ITPA subtests plus the WISC Verbal IQ, WISC Performance IQ, the Los Angeles Test of Perceptual-Motor Attributes and Draw-a-Person Test were analyzed with the alpha factor and principal component analyses together with factor matching. Without loss of generality, both studies support the channel separation in the theoretical model. The need for additional tests based on developmental psycholinguistics and for a test-teach-test process in diagnosis of the mentally retarded is emphasized.

Further Analysis of the Structure of the Revised Illinois Test of Psycholinguistic Abilities for Moderately Mentally Retarded Children

Construct validity of the Revised Illinois Test of Psycholinguistic Abilities (ITPA) was studied by Hare, Hammill, and Bartel (1973) with parallel criterion tests to match six selected subtests with 126 third grade "normal-achieving" children. A further study was done by Newcomer, Hare, Hammill and McGettigan (1974) using 20 external criterion tests with 167 nine-year-old children of "normal" intelligence. Results of both studies seemed to support the construct validity of the ITPA and the evidence for separate and measurable psycholinguistic abilities. The dimensions of level and process in the theoretical model received the most empirical substantiation while channel separation the least. This finding is at variance with that of Meyers' (1969) in his comprehensive synthesis of factorial studies of the 1961 ITPA. A recent study by Doughtie, Wakefield, Sampson, and Alston (1974) using a factor-analytic method relatively unaffected by the idiosyncracies of rotation showed that the theoretical model of the ITPA was reliably approximated by the representational level subtests on data obtained from the six oldest age groups, but not the two youngest age groups, in the original standardization sample of Paraskevopoulos and Kirk

(1969). In view of these findings and of the paucity of empirical information on the dimensions of the ITPA for retarded children two studies were undertaken to examine if the test as used with moderately mentally retarded children fits the theoretical model.

STUDY 1

The first study reported in detail elsewhere (Leong, 1974) is summarized below. A factorial study of the Revised ITPA was carried out with 98 moderately mentally retarded school children to determine the domain mapped by the subtests and whether these fit the theoretical psycholinguistic model of channels, processes and levels of communication. There were 54 boys and 44 girls. Of the 98 children 34 were diagnosed as Down's Syndrome cases, 36 as brain-injured and the remaining 28 as familial retardates. The mean chronological age of the group was 144.31 months with a standard deviation of 8.69 months. The mean Psycholinguistic Age (PLA) was 62.14 months with a standard deviation of 16.51 months. Raw scores from the 10 ITPA subtests together with Binet IQ were subjected to three methods of analysis: the alpha factor analysis, the image analysis and principal component analysis to obtain "method independent" and more meaningful results. Very briefly, the alpha factor analysis attempts to maximize the fit of the common factors for the sample of

variables to the hypothetical common factors for the universe of variables in the domain. In the image analysis squares of the multiple correlation coefficients (SMC) for each variable with the (n - 1) other variables are inserted in the principal diagonal as the SMC estimate is the most stable and one towards which other estimates tend to converge. The common parts of the data are defined as the regression estimates of each variable regressed on all the others and what is factor analyzed is the covariance matrix of the regression estimates. Both the alpha factor analysis and image analysis would overcome some of the methodological problems inherent in the principal component analysis. In Study 1 factor loadings from the alpha factor and image analyses were tested for congruence by the Schonemann (1966) method and a factor "reliability" study was carried out with separate principal component analyses on two random subsamples of 49 children each. Table 1 shows the dimensions of the ITPA for this group of retarded children.

Insert Table 1 about here

Figure 1 shows the "goodness of fit" of matching the matrices of factor loadings from the alpha factor and image analyses.

Insert Figure 1 about here

The Schonemann procedure yielded 0.13454 as the largest value and 0.00266 as an average sum of squares for the error matrix. The trace value of 0.00266 shows similarity according to heuristic guidelines provided by Skakun, Maguire, and Hakstian (1972).

STUDY 2

In the second study an alpha factor analysis and a principal component analysis were carried out on the 10 subtests of the ITPA together with the WISC Verbal IQ, WISC Performance IQ, the Los Angeles Test Battery of Perceptual-Motor Attributes (Cratty, 1966) and Draw-a-Person Test (Harris, 1963). The sample consisted of 59 moderately mentally retarded children with 34 boys and 25 girls. Of the 59 children 18 were diagnosed as Down's Syndrome cases, 26 as brain-injured and 15 as familial retardates. The mean chronological age of the group was 131.36 months with a standard deviation of 24.55 months. The mean Stanford Binet IQ was 47.71 with a standard deviation of 7.88. Table 2 shows the dimensions of the Revised ITPA plus the 4 tests for the sample of 59 moderately mentally retarded children.

Insert Table 2 about here

Figure 2 shows the degree of congruence of the alpha factor loadings with those of the principal component analysis as tested with the Schonemann method.

Insert Figure 2 about here

The largest error value was 0.06923 while the average sum of squares for the error matrix was 0.00082. According to the Skakun, Maguire, and Hakstian guideline this observed trace value of 0.00082 was not significant and showed that the factor patterns from the two methods of analyses were similar. As these researchers are quick to point out, the "goodness of fit" of a solution is a configural judgment and is measured by result, not by procedure.

DISCUSSION

Results of Study 1 showed that the three methods of analysis yielded similar factor/component patterns and that two broad dimensions emerged from the 10 ITPA subtests and the Binet. The alpha factor analysis accounted for 57.52 per cent of the total variation with 29.29 per cent for Factor 1 and 28.23 per cent for Factor II. The image analysis accounted for 51.28 per cent of the total variation with 26 per cent and 25.28 per cent on the two factors respectively. The principal component

analysis accounted for 64.46 per cent of the total variation with 32.74 and 31.72 per cent of variance for each of the components respectively. Auditory Reception, Auditory Association, Auditory Sequential Memory and Grammatical Closure loaded on the first factor and Visual Reception, Visual Association, Manual Expression, Visual Sequential Memory and Visual Closure loaded on the second factor while Verbal Expression and the Binet IQ almost co-loaded on both factors. Factor I may be labelled "Auditory Organization" and Factor II "Visual Organization". Results of Study 2 tended to confirm those of the first study. The alpha factor analysis accounted for 60.48 per cent of the total variance with 33.32 per cent for Factor I and 27.16 per cent for Factor II. The principal component analysis accounted for 65.45 per cent of the total variation with 35.47 for Factor I and 29.71 per cent for Factor II. As previously found, Visual Reception, Visual Association, Manual Expression, Visual Sequential Memory, Visual Closure together with WISC Performance IQ, the Los Angeles Battery and the Draw-a-Person Test all loaded on Factor I. This may be termed the "Visual-Performance" Factor in view of the visual and motor activities involved. Auditory Reception, Auditory Association, Verbal Expression, Auditory Sequential Memory and Grammatical Closure together with WISC Verbal IQ all loaded on Factor II. This may be called Auditory-Verbal Factor. It is clear from both studies that essentially the same patterns

obtain. The Revised ITPA as used with moderately mentally retarded children approximate most the channel separation in the three-dimensional theoretical model. This differentiation into the visual and auditory factors/components as found in two separate studies is in line with the synthesis of a number of studies evaluated by Meyers (1969) with the experimental version of the ITPA.

The finding of channel separation relates to the question of unisensory or multisensory training (Leong, 1974). With the retarded there is probably a hierarchical organization of sensory systems (Birch, 1962), and training programs should be arranged accordingly. Earlier, Mann (Mann, 1970; Mann & Phillips, 1967) warned of the danger of "fractionating" special educational practices while recognizing attempts such as the Frostig or the ITPA to provide "structure and specificity" in training exceptional children. More recently, Ysseldyke and Salvia (1974) examine the extent to which assumptions underlying diagnostic-prescriptive teaching are met within the ability training and task analysis models. From the "forecasting efficiency" coefficients computed for a number of commonly used measures including the subtests of the ITPA, they point out that the low forecast efficiency of many of the purportedly discrete measures lends little support to the claim that instruction can be

prescriptively differentiated on the basis of differential performance on aptitude measures. More specifically, Hammill and Larsen (1974) review the results of 38 studies which attempted to train children in psycholinguistic skills and which used the ITPA as the criterion of improvement. They suggest that the efficiency of training psycholinguistic functionings has not been conclusively demonstrated. However, they are careful to point out that it is difficult to say whether "some of the subtests are unresponsive to instructional efforts because they are basically impossible or extremely difficult to teach, because training programs do not provide sufficient attention to them, or because the ITPA subtests are not appropriate measures of these constructs ..." (Hammill & Larsen, 1974, p. 12).

These salutary remarks serve to remind us of the complexities in mapping out the psycholinguistic profile of moderately mentally retarded children. Empirical studies have shown that it is not so much visual and perceptual impairment that impedes their learning; rather, they need longer time to solve a problem and stimuli complexity needs to be broken down (O'Connor & Hermelin, 1962). Performance in the Auditory Sequential Memory subtest in the ITPA will illustrate this. Inability to repeat a series of digits correctly on the part of retardates can be due in part to their failure to chunk or group the stimuli. Using a modified

digit span test with visual presentations, Spitz (1966) showed a substantial facilitory effect of grouping of the digits upon performance of retarded children with an average IQ of 60. Spitz (1973) further shows that educable mental retardates differ from non-retardates in the speed and manner in scanning and selectively organizing materials for storage and that grouping or subjective cueing can lead to more successful retrieval.

Thus the diagnosis of the retarded, whether using the ITPA or other measures, should be a continuous test-teach-test process. This mini-learning situation has been found to provide more stable results than single occasions of diagnosis. In stressing that "the teaching itself carries the burden of diagnosis" Tyson (1970, p. 670-671) explains that "the payoff from different approaches gives some indication as to where the difficulties lie; but some general idea at least of the area of difficulty must be available in order to establish the initial teaching techniques that are to be employed."

The relevant question of separate but related one-trial diagnosis of psycholinguistic abilities should also be considered. One criticism of the ITPA is that it does not take into account current theories of developmental psycholinguistics. The Kirk-Osgood-Wepman model on which the test is based is the product of learning theory, information theory and structural linguistics. The test could well be supplemented by such measures as the

Houstin Test for Language Development (Crabtree, 1958), the Northwestern Syntax Screening Test (Lee, 1969, 1970), the Clay's Sentence Repetition Test (Clay, 1971), the Reynell Developmental Language Scales (Reynell, 1969), to name just a few. In commenting on the language behavior and language training of the moderately mentally retarded, Leong (1975) finds the "neopsycholinguistic's" position tenable and the need to use the behavioristic approach for habilitation within the developmental psycholinguistic framework.

References

Birch, H. G. Dyslexia and the maturation of visual function. In Money, J. (Ed.) Reading Disability: Progress and Research Needs in Dyslexia. Baltimore: Johns Hopkins, 1962, Pp. 161-169.

Clay, M. M. Sentence repetition: elicited imitation of a controlled set of syntactic structures by four language groups. Monographs of the Society for Research in Child Development, 1971, 36, 3 (Serial No. 143).

Crabtree, M. The Houston Test for Language Development. Houston: Houston Test Co., 1958.

Cratty, B. J. The Perceptual-Motor Attributes of Mentally Retarded Children and Youth. Los Angeles: Los Angeles County Mental Retardation Services Board, 1966.

Doughtie, E. B., Wakefield, J. A. Jr., Sampson, R. N., & Alston, H. L. A statistical test of the theoretical model for the representational level of the Illinois Test of Psycholinguistic Ability. Journal of Educational Psychology, 1974, 66, 3, 410-415.

Hammill, D. D., & Larsen, S. C. The effectiveness of psycholinguistic training. Exceptional Children, 1974, 41, 1, 5-14.

Hare, Betty A., Hammill, D. D., & Bartel, Nettie R. Construct validity of selected subtests of the ITPA. Exceptional Children, 1973, 40, 1, 13-20.

Harris, D. B. Goodenough-Harris Drawing Test Manual. New York: Harcourt, Brace and World, 1963.

Lee, Laura. The Northwestern Syntax Screening Test. Evanston, Illinois: Northwestern University Press, 1969.

Lee, Laura. A screening test for syntax development. Journal of Speech and Hearing Disorders, 1970, 35, 103-112.

Leong, C. K. If the model fits -- an analysis of the structure of the Revised Illinois Test of Psycholinguistic Abilities for moderately mentally retarded children. The Slow Learning Child, 1974, 21, 2, 100-113.

Leong, C. K. Language behavior of moderately mentally retarded children. In Das, J. P., & Baine, D. (Ed.) Mental Retardation for Special Educators. Springfield, Illinois: Charles C. Thomas, 1975 (in press).

Mann, L. Perceptual training: misdirections and redirections. American Journal of Orthopsychiatry, 1970, 40, 1, 30-38.

Mann, L., & Phillips, W. Fractional practices in special education. Exceptional Children, 1967, 34, 311-317.

Meyers, C. E. What the ITPA measures: a synthesis of factor studies of the 1961 edition. Educational and Psychological Measurement, 1959, 29, 867-876.

Newcomer, Phyllis, Hare, Betty, Hammill, D., & McGettigan, J. Construct validity of the ITPA. Exceptional Children, 1974, 40, 7, 509-510.

O'Connor, N., & Hermelin, B. Speech and Thought in Severe Subnormality. London: Pergamon, 1962.

Paraskevopoulos, J., & Kirk, S. A. The Development and Psychometric Characteristics of the Revised Illinois Test of Psycholinguistic Abilities. Urbana, Illinois: University of Illinois Press, 1969.

Reynell, Joan. Reynell Developmental Language Scales. Windsor, U.K.: National Foundation for Educational Research, 1969.

Schonemann, P. H. A generalized solution of the orthogonal procrustes problem. Psychometrika, 1966, 31, 1-10.

Skakun, E. N., Maguire, T. O., & Hakstian, A. R. An application of inferential statistics to the factorial invariance problem. Research & Information Report, Division of Educational Research Services, University of Alberta, April, 1972.

Spitz, H. H. The role of input organization in the learning and memory of mental retardates. In Ellis, N. R. (Ed.) International Review of Research in Mental Retardation. Vol. 2. New York: Academic Press, 1966. Pp. 29-56.

Spitz, H. H. Consolidating facts into the schematized learning and memory system of educable retardates. In Ellis, N.R. (Ed.) International Review of Research in Mental Retardation. Vol. 6, New York: Academic Press, 1973. Pp. 149-168.

Tyson, Moya. The design of remedial programmes. In Mittler, P. (Ed.) The Psychological Assessment of Mental and Physical Handicaps. London: Methuen, 1970. Pp. 667-693.

Ysseldyke, J. E., & Salvia, J. Diagnostic-prescriptive teaching: two models. Exceptional Children, 1974, 41, 3, 181-185.

Footnote

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Table 1

Dimensions of the Revised ITPA for Moderately Mentally Retarded Children (N=98) by Three Methods of Analysis

Subtests	Varimax Orthogonally Rotated Factors								
	Alpha Factor Analysis with SMC in Main Diagonal			Image Analysis with SMC in Main Diagonal			Principal Component Analysis with Unities in Main Diagonal		
	I	II	h^2	I	II	h^2	I	II	h^2
1. Auditory Reception	.581	.405	.502	.537	.413	.459	.660	.374	.575
2. Auditory Association	.747	.407	.724	.681	.431	.650	.778	.386	.754
3. Verbal Expression	.559	.577	.646	.559	.552	.617	.589	.580	.683
4. Visual Reception	.406	.610	.537	.411	.565	.488	.403	.662	.601
5. Visual Association	.184	.811	.691	.251	.678	.523	.168	.849	.750
6. Manual Expression	.355	.567	.448	.309	.543	.424	.334	.654	.539
7. Auditory Sequential Memory	.691	.225	.527	.675	.241	.514	.824	.136	.697
8. Grammatical Closure	.883	.277	.866	.771	.353	.719	.870	.286	.838
9. Visual Sequential Memory	.303	.593	.443	.275	.581	.413	.245	.706	.559
10. Visual Closure	.323	.691	.582	.339	.628	.510	.301	.755	.661
11. Binet IQ	.476	.367	.361	.439	.364	.325	.571	.329	.434
Per Cent Total Variation	29.29	28.23	57.52	26.00	25.28	51.28	32.74	31.72	64.46
Per Cent Common Variation	50.92	49.08		50.70	49.30		50.79	49.21	
Eigenvalues	*9.869	*1.133		15.199	2.755		6.009	1.031	

*Convergence reached at 6th Iteration, Tolerance Level=.005

Table 2

Dimensions of the Revised ITPA plus 4 Tests for Moderately Mentally Retarded Children (N=59) by Two Methods

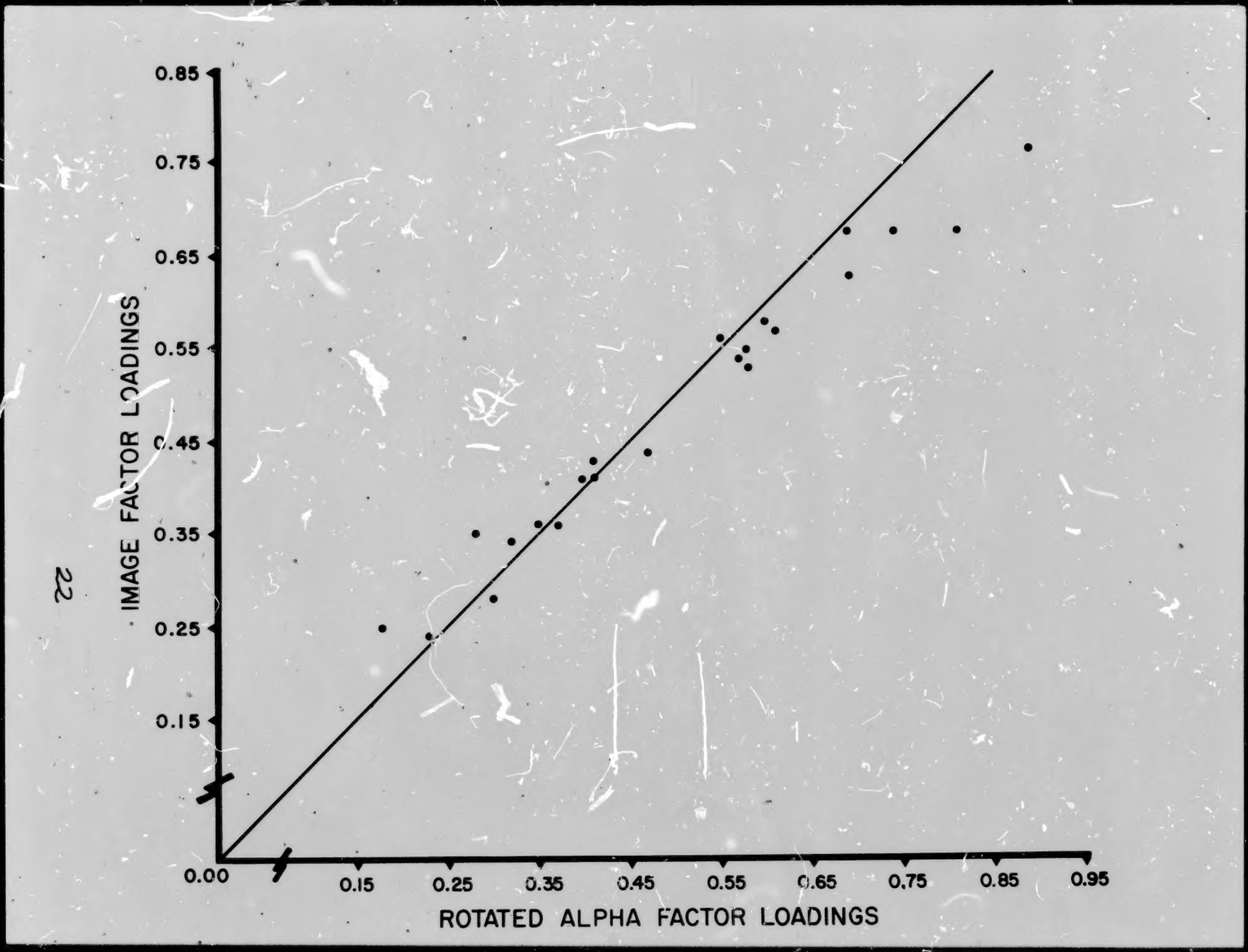
Variables	Varimax Orthogonally Rotated Factors/Components from Alpha Factor Analysis with SMC in Main Diagonal			Principal Component Analysis with Unities in Diagonal		
	I	II	h^2	I	II	h^2
1. Auditory Reception	.422	.646	.595	.397	.704	.654
2. Auditory Association	.287	.812	.742	.270	.844	.784
3. Verbal Expression	.532	.571	.610	.515	.624	.654
4. Visual Reception	.560	.345	.433	.589	.357	.475
5. Visual Association	.791	.233	.680	.807	.228	.703
6. Manual Expression	.492	.227	.294	.557	.218	.358
7. Auditory Sequential Memory	.130	.697	.503	.076	.801	.648
8. Grammatical Closure	.189	.905	.855	.181	.905	.853
9. Visual Sequential Memory	.567	.267	.392	.652	.243	.485
10. Visual Closure	.680	.249	.524	.732	.246	.597
11. WISC VIQ	.565	.735	.859	.544	.745	.851
12. WISC PIQ	.852	.371	.865	.831	.384	.838
13. Los Angeles Battery	.680	.093	.471	.760	.052	.581
14. Draw-a-Person	.771	.224	.645	.796	.220	.684
Per Cent Total Variation	33.32	27.16	60.48	35.74	29.71	65.45
Per Cent Common Variation	55.08	44.92		54.91	45.09	
Eigenvalues	*10.71	*2.10		7.461	1.702	

*Convergence reached at 3rd Iteration tolerance level = 0.01

Figure Caption

Figure 1. Factor matching of alpha factor and image analyses for 98 retarded children.

Figure 2. Factor matching of alpha factor and principal component analyses with 59 retarded children.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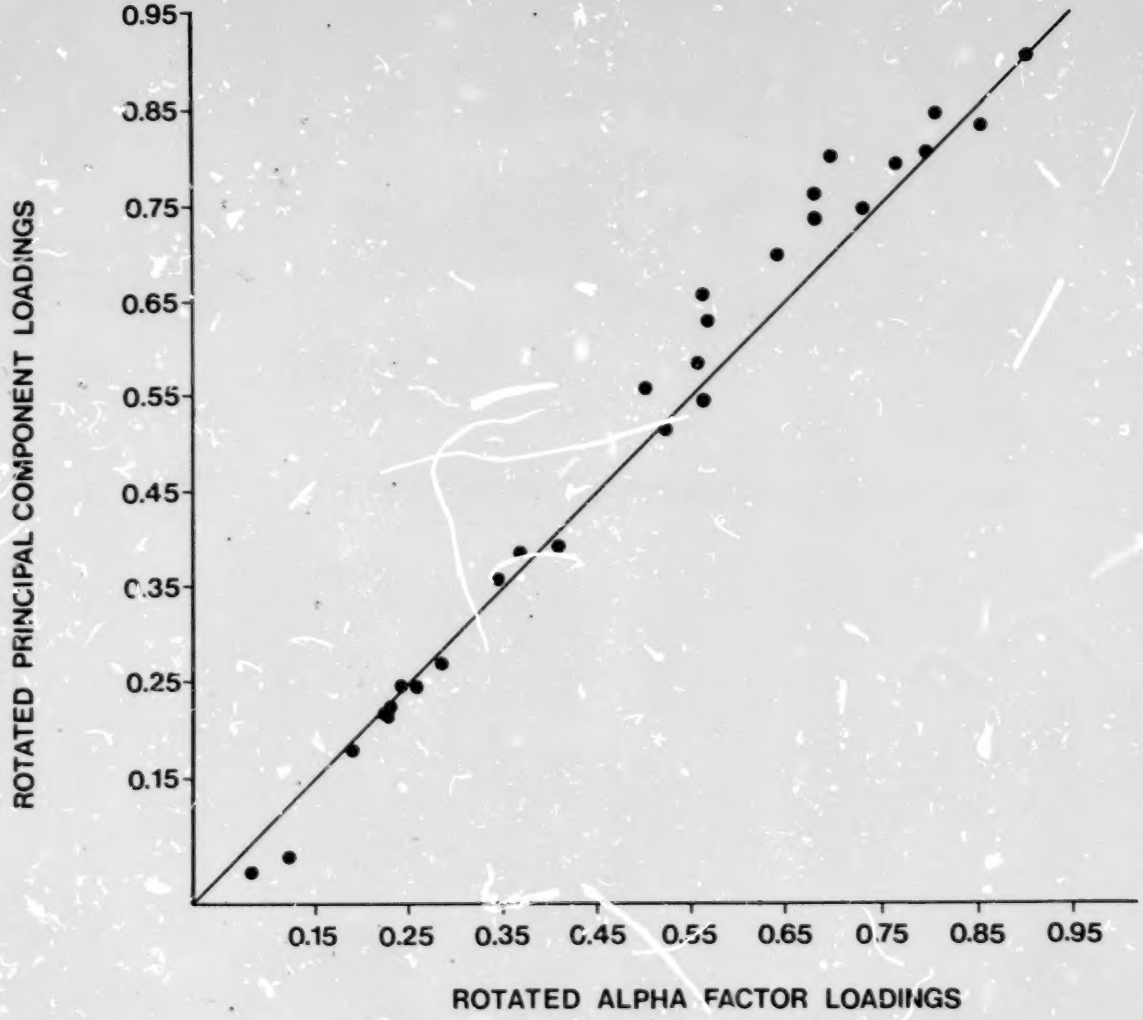
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